CA | Energy Efficiency Strategic Plan

Lighting Action Plan Workshop

November 7, 2013 / 9:30a – 5:00p PST

SDG&E Energy Innovation Center, San Diego, CA

California Public Utilities Commission
Energy Division

Agenda Overview

CA Energy Efficiency Strategic Plan

- Workshop Overview
- Strategy Level Updates
- < LUNCH >
- Lighting Technology Overview
- Break-Out Group Discussions: Best Practices by Sector
- Wrap-Up and Next Steps
- Strategy Group Meetings

Questions on the phone?

CA Energy Efficiency Strategic Plan

- Webinar participants should ask questions using the CHAT (Q&A) window
  - We will be monitoring the chat window during the webinar

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WORKSHOP OVERVIEW

Objectives

- Provide an update from Champions on LAP progress

- Solicit feedback from workshop participants regarding key LAP initiatives

Introductions

- Jeorge Tagnipes, CPUC Energy Division
- Jenna Canseco, DNV KEMA Energy & Sustainability
- Partners from the California Lighting Technology Center
- Other valued stakeholders...
  - In the room
  - On the phone

Process

- Morning presentations
  - Strategy 1,2, 6, 7 ~ 25 minutes
  - Strategy 3, 4, 5 ~ 10 minutes
- Lunch
- 2010 Lighting Technology Overview ~ 30 minutes
  - Breakout session by sector
  - Reports on discussions
- Wrap-Up and Next Steps
- Strategy Group Meetings

CA | Energy Efficiency Strategic Plan

LIGHTING ACTION PLAN STRATEGY-LEVEL UPDATES

CA | Energy Efficiency Strategic Plan

LAP UPDATES
Goal 1
Strategy 1

Goal 1

CA Energy Efficiency Strategic Plan

- **Goal 1** – POLICY

  Develop and implement coordinated policies, procedures, and other market interventions that eliminate barriers, accelerate lighting market transformation in California and provide incentives for best practice lighting technologies and systems.

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.
  - Champions:
    - Michael Mutmansky, TRC
    - Michael Nguyen, SDG&E
    - Lisa Parker, SCE
    - Angi Xanders, DNV KEMA Energy & Sustainability

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.

Initiative	Key Actions	Timeline
1-1: Provide input to CEC 2017 Title 24 code process to ensure that viable best practice lighting technologies are adopted into code	Conduct literature review of potentially viable lighting technologies (e.g., lighting controls) for adoption into code	COMPLETE
	Develop list of recommended changes to code or technologies to include in new code	COMPLETE
	Document code change recommendations	Q3 2013
	Provide input to code process based on above document	Q3 2013
1-2: Encourage cities and counties to ensure inclusion of best practice lighting technologies and systems beyond Title 24 requirements into local building codes ("reach codes")	Research and document examples of how some communities have included best practice lighting technologies and systems into local building codes ("reach codes")	Q3 2013
	Meet with representatives from 2-3 cities or counties to discuss possibility of improved lighting codes and share research results	Q4 2013
	Develop logic model diagram that shows how a technology moves into codes and standards	Q1 2014
	Conduct follow-up outreach to each targeted community to support code adoption	2014
1-3: Advocate for changes to green building rating systems (e.g., CalGreen, LEED) to encourage incorporation of best-practice lighting technologies and systems into all green buildings	Understand the relevant rating system organization's internal processes for making changes	COMPLETE
	Conduct a literature review regarding typical lighting systems in existing green buildings certified by the relevant rating organization(s)	Q3 2013
	Prepare examples of possible improvements to these typical scenarios showing benefit-cost analyses	Q3 2013
	Meet with rating system representatives to discuss possible benefit from changes to incorporate best practice lighting technologies and systems into green buildings	Q4 2013
	Conduct ongoing follow-up with rating system representatives to keep this issue current with them	2014

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.

Initiative	Key Actions	Timeline	COMPLETE?
1-1: Provide input to CEC 2017 Title 24 code process to ensure that viable best practice lighting technologies are adopted into code	Document code change recommendations	Q3 2013	YES
	Provide input to code process based on above document	Q3 2013	YES
1-2: Encourage cities and counties to ensure inclusion of best practice lighting technologies and systems beyond Title 24 requirements into local building codes ("reach codes")	Research and document examples of how some communities have included best practice lighting technologies and systems into local building codes ("reach codes")	Q3 2013	YES
1-3: Advocate for changes to green building rating systems (e.g., CalGreen, LEED) to encourage incorporation of best-practice lighting technologies and systems into all green buildings	Conduct a literature review regarding typical lighting systems in existing green buildings certified by the relevant rating organization(s)	Q3 2013	YES
	Prepare examples of possible improvements to these typical scenarios showing benefit-cost analyses	Q3 2013	YES

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.
  - Initiative 1-1: Provide input to CEC 2016 Title 24 code process to ensure that viable best practice lighting technologies are adopted into code
  - **Key Action: Provide input to code process based on above document**
  - Status: Completed

  Recommendation: Title 24 change recommendations:

  In situations where more than 10% of the lighting is being changed out on a premise of 5,000 sqf or larger, the lighting is required to have at least 4 different lighting control strategies from the following list:

  1. Controllable Window Shades
  2. Multi levels dimming
  3. Personal light control
  4. Constant illuminance control
  5. Occupancy sensing
  6. Demand response

  - Brief Update:
    - The CASE measure for interior nonresidential lighting in the 2017 process will include this input as part of the stakeholder input, and will determine what actions can be made to accommodate the recommended changes.

Goal 1

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.
  - Initiative 1-2: Encourage cities and counties to ensure inclusion of best practice lighting technologies and systems beyond Title 24 requirements into local building codes ("reach codes")
  - **Key Action: Research & documents examples of how some communities have included best practice lighting technologies and systems into local building codes ("reach code")**
  - Status: Completed
  - Brief Update:
    - 44 reach codes approved in 2009-2013, requiring more stringent energy requirements than those set by 2008 T24, Part 6 by average 15% lower.
    - 17 of 44 (39%) reach codes have explicit requirements on lighting.
    - Best practice lightings required ➔ LPD limits, high efficient T8 luminaires, lower wattage CFLs, occupancy sensor, daylight sensor, daylight harvesting, O&M and BUG rating.
    - Review "voluntary reach code" as possible strategy for IOUs-local jurisdiction collaboration
    - Collaborate with local jurisdiction to include Initiative 1-1 's recommendations into "reach code" before 2017 T24

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.
  - Initiative 1-3: Advocate for changes to green building rating systems (e.g., CalGreen, LEED) to encourage incorporation of best-practice lighting technologies and systems into all green buildings
  - **Key Action: Conduct a literature review regarding typical lighting systems in existing green buildings certified by the relevant rating organization(s)**
  - Status: Completed
  - Brief Update:
    - Identifying publically available literature has been a challenge and we are resource constraint (in time, money, and subject expertise).
    - For Commercial – Our team's knowledge uncovered existing lighting system information in LEED certification.
    - For Residential – Discovered that DNV KEMA (Kara Kokernak) is working with SCE to develop a "Certification Optimizer" incorporating 6 certification targets that would analyze measures across each rating system. Currently in research phase. After research concluded, web-based tool development in 2014.

Goal 1 – Initiative 1-3 Update

- Key Action: Conduct a literature review regarding typical lighting systems in existing green buildings certified by the relevant rating organization(s)

Residential 'Certification Optimizer' Lighting Research

LEED for Homes	GreenPoint Rated	ENERGY STAR Certified Homes, v3	DOE Challenge Home	CalGreen (Residential Voluntary Measures)
8.1 Title 24 Lighting - Meet the requirements of Title 24 Lighting in CA (prereq)	5. Install High-Efficacy Lighting and Design Lighting System	ENERGY STAR certified light bulbs or fixtures shall be installed in 80% of RESNET-defined Qualifying Light Fixture Locations	80% of lighting fixtures are ENERGY STAR Qualified or ENERGY STAR lamps (bulbs) in minimum of 80% of sockets	Building lighting consists of at least 90 percent ENERGY STAR qualified hard-wired fixtures
8.2 Improved Lighting (meet one of the following): a) Indoor lighting - three ENERGY STAR lights b) Exterior lighting - four PV-integrated lights	a. Install High-Efficacy Lighting			
8.3 Advanced Lighting Package (meet one of the following): a) all lighting is high-efficiency b) at least 60% of fixtures are ENERGY STAR labeled c) at least 90% of all lamps are ENERGY STAR labeled	b. Install a Lighting System to IESNA Footcandle Standards or Hire Lighting Consultant			

Goal 1 – Initiative 1-3 Update

CA Energy Efficiency Strategic Plan

- Strategy 1: Scale and align state codes and standards to address the goals articulated in the Lighting Action Plan.
  - Initiative 1-3: Advocate for changes to green building rating systems (e.g., CalGreen, LEED) to encourage incorporation of best-practice lighting technologies and systems into all green buildings
  - **Key Action: Prepare examples of possible improvements to these typical scenarios showing benefit-cost analyses**
  - Status: Completed
  - Brief Update:
    - LEED v4 has adopted IES/IDA Model Lighting Ordinance to address exterior light trespass
    - Future LEED requirements should include IES Recommended Practice guidelines with zonal lumen requirements for glare control in offices (IES RP-1)

Goal 1 – Initiative 1-3 Update

- Key Action: Prepare examples of possible improvements to these typical scenarios showing benefit-cost analyses
- Lighting performance goes beyond energy savings
  - Color temperature, color rendering, glare control, and distribution including uniformity should be considered
  - IES/ANSI Recommended Practice 1: Office Lighting
    - Maximum candela at given angles to reduce glare

Angle from vertical	VDT-intensive	Normal
55 degrees	300 cd	-
65 degrees	220 cd	300 cd
75 degrees	135 cd	185 cd
85 degrees	45 cd	60 cd

Goal 1 – Initiative 1-3 Update

- Key Action: Prepare examples of possible improvements to these typical scenarios showing benefit-cost analyses
- Cost benefits include individual productivity*
  - 12 studies linking improved lighting design decisions with 0.7-23% gains in individual productivity
    - Four demonstrate 3-23% improved performance with introduction of indirect/direct lighting systems
    - Four demonstrate 3-13.2% improved performance from higher quality fixtures – higher performance electronic ballasts and parabolic louvers
    - Four demonstrate 0.7-2% improved performance from higher illuminance levels and daylight simulating luminaires
      - *Linking Energy to Health and Productivity in the Built Environment

        Advanced Building Systems Integration Consortium (ABSIC)

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LAP UPDATES
Goal 1
Strategy 2

Goal 1

CA Energy Efficiency Strategic Plan

- **Goal 1** – POLICY

  Develop and implement coordinated policies, procedures, and other market interventions that eliminate barriers, accelerate lighting market transformation in California and provide incentives for best practice lighting technologies and systems.

Goal 1

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.
  - Champions:
    - Jeorge Tagnipes, CPUC Energy Division
    - Amul Sathe, Navigant Consulting, Inc.

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.

Initiative	Key Actions	Timeline
2-1: Create a tool to establish the baseline electric lighting energy consumption against which to track Lighting Action Plan progress	Engage an independent third party to leverage the CPUC's 2012 Goals & Potentials Study (and subsequent updates) and estimate baseline electric lighting energy consumption for 2010	Complete
	Project energy consumption forward through 2020 – both including and excluding projected savings from IOU energy efficiency programs and codes & standards	Complete
	Update results as model inputs become available (e.g., for street lights, LED lamps, and updated information regarding the impacts of codes & standards)	Q3 2013
	Share results and obtain feedback from a stakeholder group including representatives from the CPUC, other government agencies, utilities, and industry	Q3 2013
2-2: Update the baseline tool enable scenario analyses for different technologies and markets	Review ability to update existing baseline model with different scenarios (e.g., based on product adoption timelines and/or pricing) to help understand the market potential and the effects of each scenario on energy savings	Q3 2013
	Review and prioritize available information for development of scenarios	Q4 2013
	Build scenario analysis capabilities within the model	Q1 2014
	As available, continue to share results from model with utility program teams and other stakeholders; encourage utilities to use results for program planning purposes	Ongoing

Goal 1

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.

Initiative	Key Actions	Timeline	Complete?
2-1: Create a tool to establish the baseline electric lighting energy consumption against which to track Lighting Action Plan progress	Update results as model inputs become available (e.g., for street lights, LED lamps, and updated information regarding the impacts of codes & standards)	Q3 2013	**YES**
	Share results and obtain feedback from a stakeholder group including representatives from the CPUC, other government agencies, utilities, and industry	Q3 2013	**YES**
2-2: Update the baseline tool enable scenario analyses for different technologies and markets	Review ability to update existing baseline model with different scenarios (e.g., based on product adoption timelines and/or pricing) to help understand the market potential and the effects of each scenario on energy savings	Q3 2013	**In Progress**

Goal 1

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.
  - Initiative 2-1: Create a tool to establish the baseline electric lighting energy consumption against which to track Lighting Action Plan progress
  - **Key Action: Update results as model inputs become available (e.g., for street lights, LED lamps, and updated information regarding the impacts of codes & standards)**
  - Status: Completed
  - Brief Update:
    - Updated model shows savings in 2020 is 36% relative to the baseline based on current IOU programs and lighting standards.

Initiative 2-1: Overview

- Baseline Energy Use is defined by the following conditions:
  - In 2010 assume IOU programs and Codes and Standards (C&S) are in effect
  - After 2010, assume IOU programs cease and C&S's remain at their 2010 levels (no additional C&S's come into effect)
  - Assume limited "naturally occurring" savings in the lighting sector
- Remaining Lighting Energy Use subtracts savings from existing, funded lighting efficiency programs
  - Savings achievable from **codified lighting C&S** that come into effect after December 31st 2010
  - Savings achievable from IOU voluntary rebate programs that start in 2011 and continue through 2020

Initiative 2-1: Data Sources

- Baseline Energy Use
  - California Energy Commission (CEC) demand forecast models provided baseline energy use
  - Navigant provided CEC staff the baseline assumptions, CEC staff produced results
- Energy Savings
  - Savings from C&S and IOU programs are obtained from the 2013 CPUC Potential Goals and Targets Study (conducted by Navigant)
  - C&S savings are based on data from the CEC, DOE, and CPUC evaluations
  - IOU program savings are based on a calibrated forecast model projecting voluntary adoption of efficiency technologies as a result of IOU rebate offerings

Initiative 2-1: Scope

- Residential, Commercial, Industrial, and Street Lighting sectors are included
- Indoor and Outdoor end uses for the sectors above are included
- 2010 through 2020
- IOU service territories only (PG&E, SCE, SDG&E)
  - CPUC potential study only covers IOU territories; we cannot comment on the lighting savings potential for voluntary programs in non-IOU territories

Initiative 2-1: Previous Results

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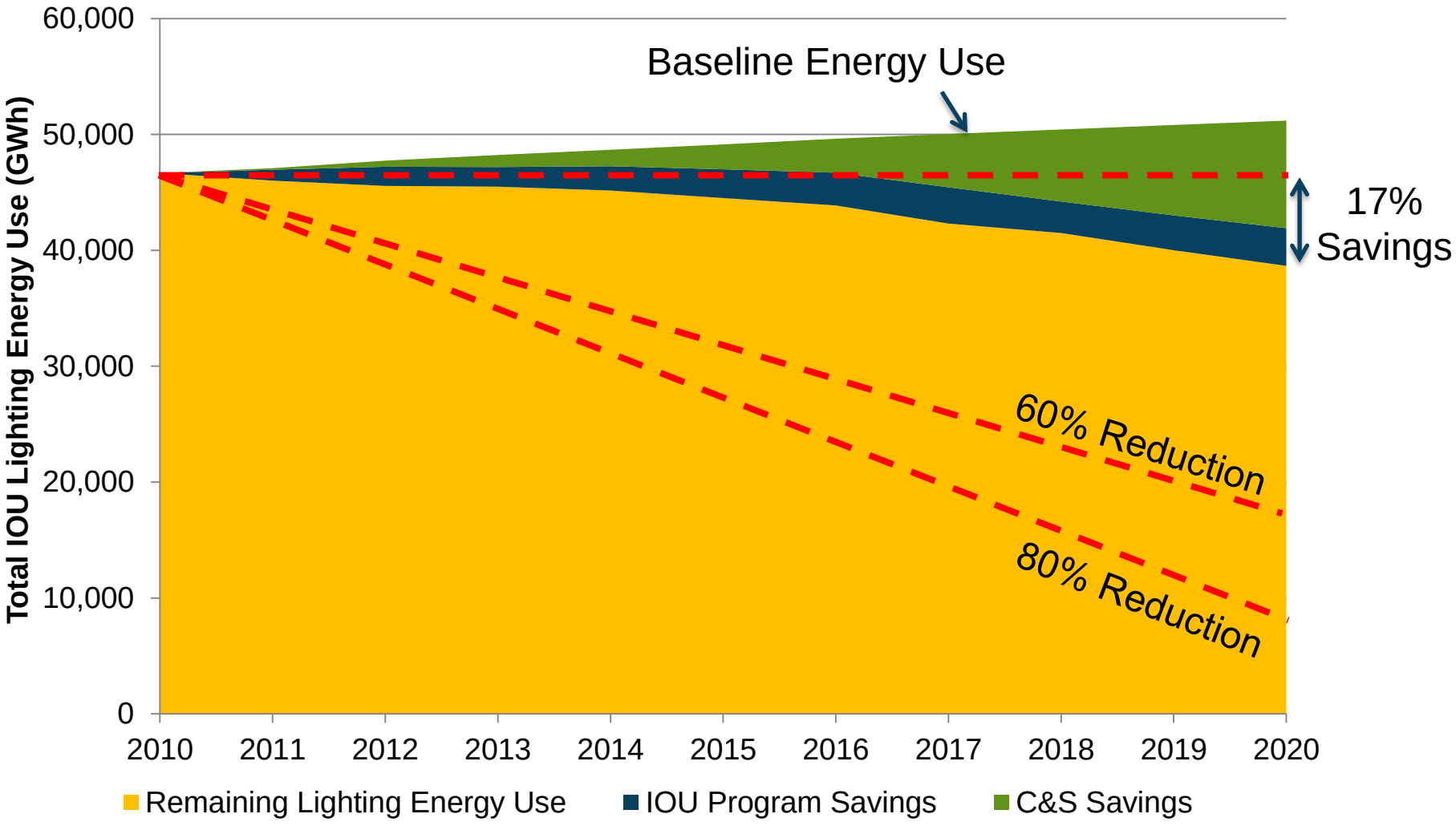
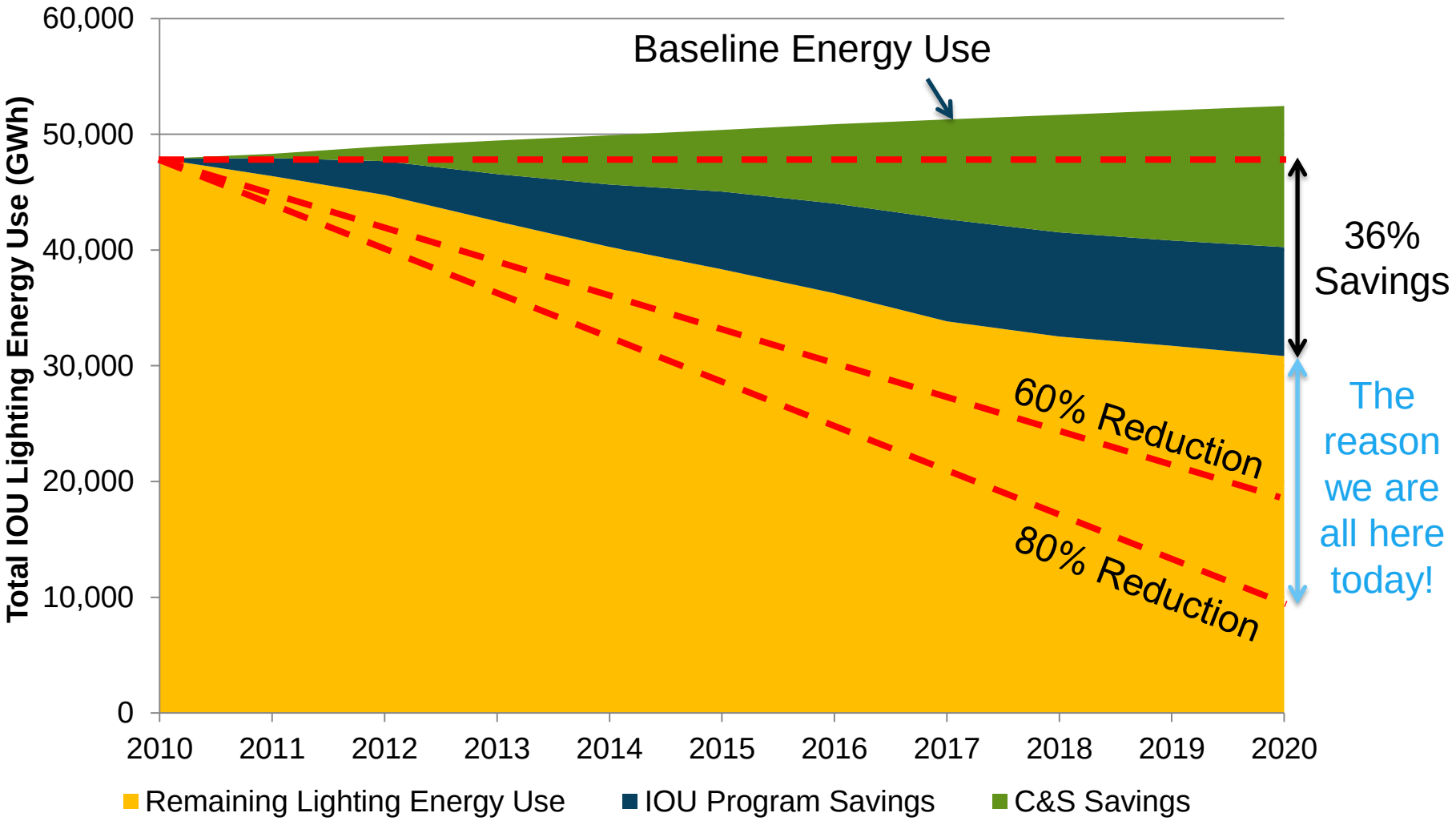


Initiative 2-1: Updated Results

CA Energy Efficiency Strategic Plan



Initiative 2-1: Key Changes in Model

- Use more recent and better data on LEDs including revisiting the risk factor that was associated with LEDs in the model.
  - Previous model showed less than 5% of IOU program lighting savings from LEDs. Updated model increased to 13%.
- Updated technology assumptions regarding high efficiency linear fluorescents (low wattage T8s).
- Revisited C&S accounting methodology.
  - In the past IOUs were able to only claim half the savings from the general service incandescent phase out from 2011-2013.
  - In this updated model we account for the full savings from those standards (we aren't constrained to just IOU attributable savings).
- Street, traffic, and sign lights are included.

Initiative 2-1: Additional Insight

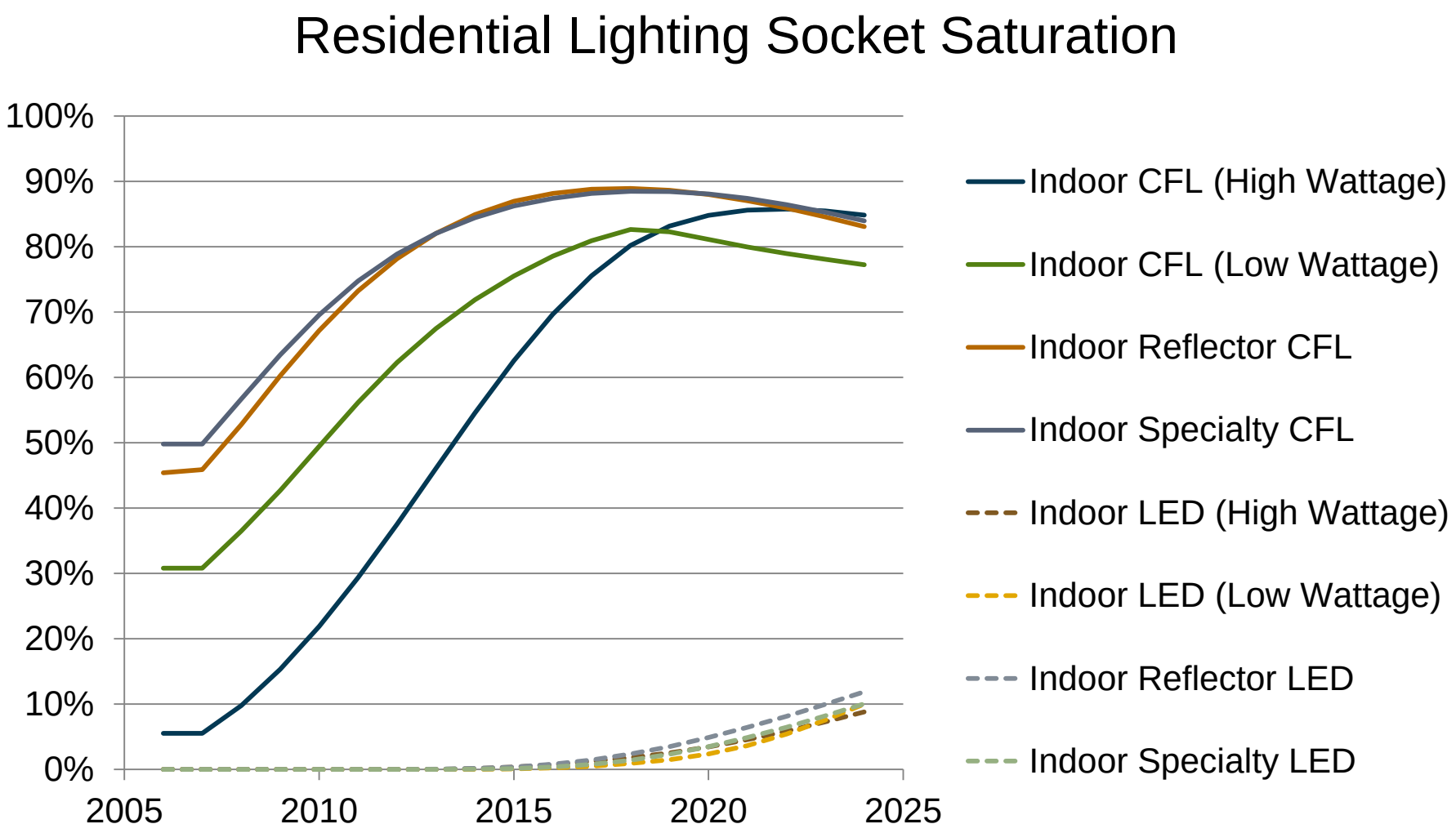
- The 2013 CPUC Potential Study Model was developed to support multiple needs:
  - CPUC's IOU energy efficiency goal setting process
  - CEC and CAISO's statewide and regional energy and demand forecasting
  - Long Term Procurement Planning
- The goal of the Potential Study Model was to produce a reliable forecast of dependable savings from measures and programs we are certain about.
  - Asset planning vs. IOU goals planning take different views of what savings are "reliable and dependable"

Initiative 2-1: Additional Insight

- Lighting upgrades are modeled to be mostly replace-on-burnout and are based on consumer decision algorithms
- Consumer decisions are made based on the comparative economics of available lighting technologies at the time the consumer needs to replace or install equipment
- Using a stock turnover framework to account for lighting change outs slows the speed at which LEDs enter the market
  - Model waits for CFLs to reach the end of their useful life (7- 14 years) before they can be eligible to be replaced with LEDs

Initiative 2-1: Additional Insight

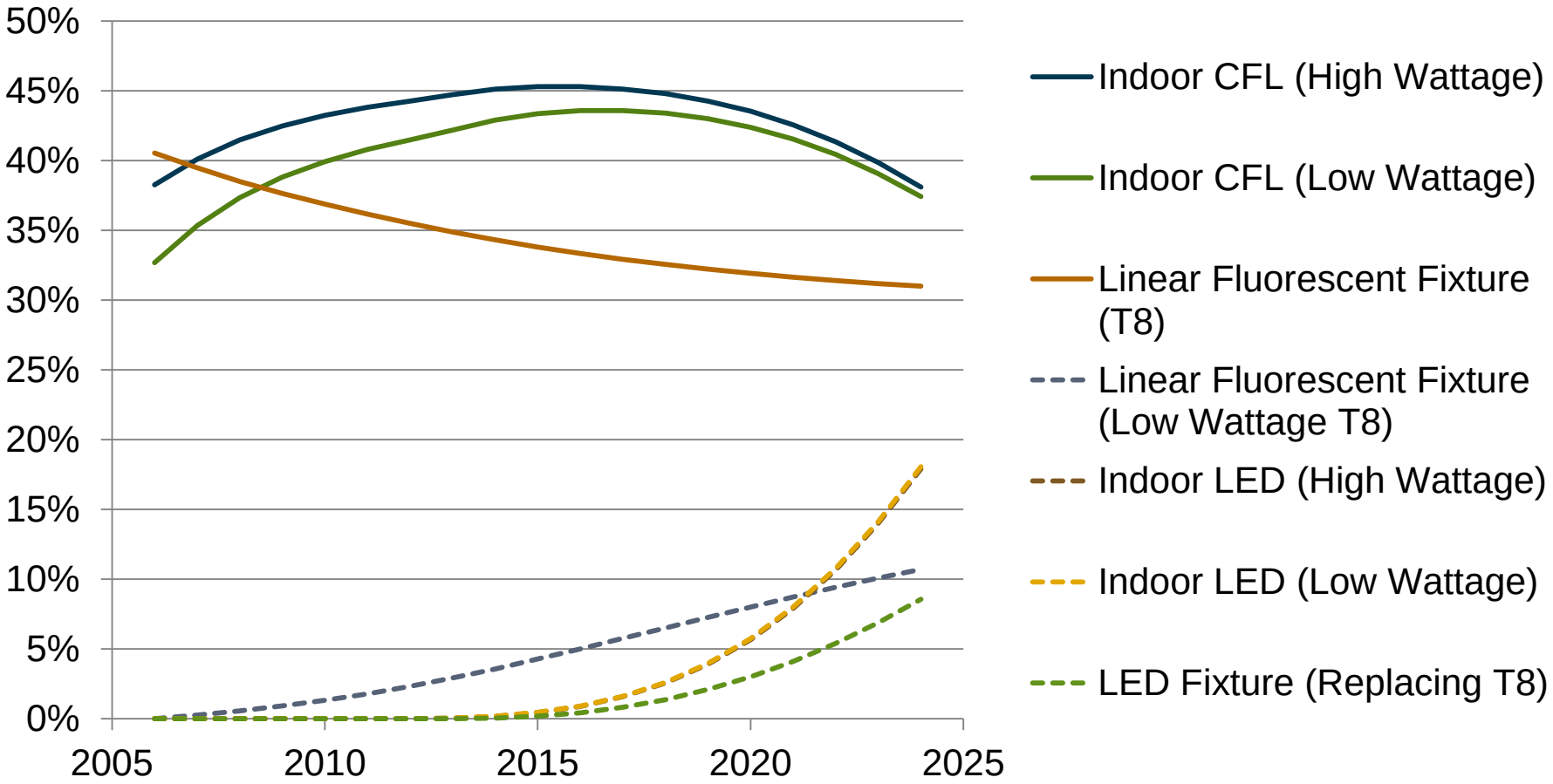
CA Energy Efficiency Strategic Plan



Initiative 2-1: Additional Insight

CA Energy Efficiency Strategic Plan

Commercial Lighting Technology Saturation



Goal 1

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.
  - Initiative 2-1: Create a tool to establish the baseline electric lighting energy consumption against which to track Lighting Action Plan progress
  - **Key Action: Share results and obtain feedback from a stakeholder group including representatives from the CPUC, other government agencies, utilities, and industry**
  - Status: Completed
  - Brief Update:
    - Comments are welcome
    - CPUC Potential model will be updated in 2014 when the new Database for Energy Efficient Resources (DEER) is released

Goal 1

CA Energy Efficiency Strategic Plan

- Strategy 2: Establish a baseline and method for quantifying how each initiative contributes to the reduction in electric lighting energy consumption.
  - Initiative 2-2: Update the baseline tool enable scenario analyses for different technologies and markets
  - **Key Action: Review ability to update existing baseline model with different scenarios (e.g., based on product adoption timelines and/or pricing) to help understand the market potential and the effects of each scenario on energy savings**
  - Status: In Progress
  - Brief Update:
    - We are considering a simplified approach to layering on additional savings from additional lighting initiatives and programs.

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LAP UPDATES
Goal 2
Strategy 3

Goal 2

- **Goal 2** – BEST PRACTICES

  Define and advance best practices for design, installation, operation and maintenance of integrated systems to achieve sustainable lighting solutions for all spaces.

Goal 2

- Strategy 3: Identify best practice lighting technologies and systems and incorporate into utility programs.
  - Champions:
    - Adam Parrish, Crossroad Services Inc. on behalf of TCP
    - Alex Alzugaray, Energy Solutions
    - Jennifer Burns, Philips Lighting Company
    - Kandice Castellino, OSRAM SYLVANIA
    - Lela Manning, Sempra Energy Utilities
    - Robert Hick, Leviton Controls
    - Vireak Ly, Southern California Edison

Goal 2

CA Energy Efficiency Strategic Plan

- Strategy 3: Identify best practice lighting technologies and systems and incorporate into utility programs.

Initiative	Key Actions	Timeline
3-1: Identify and publicize current list of best practice lighting technologies and systems	Convene a diverse group of stakeholders to review current set of best practice lighting technologies and systems	Q3 2013
	Summarize the current set of best practice lighting technologies and systems in a brief, easily-understood document	Q4 2013
	Solicit stakeholder feedback on the draft set of best practice lighting technologies and systems and finalize document	Q4 2013
	Publish best practices document and update periodically	Ongoing
3-2: Provide a straw proposal to CPUC Energy Division for how to best incorporate advanced lighting efficiency measures (including lighting systems) into utility programs as part of an integrated demand side management approach	Convene group of utility program and technology experts to identify key barriers to technologies identified in Initiative 4-1	Q1 2014
	Document key barriers and options for overcoming barriers	Q1 2014
	Present draft results and obtain comment from a regional stakeholder group (e.g., Emerging Technologies Coordinating Council)	Q2 2014
	Finalize proposal and present to Energy Division staff	Q2 2015
3-3: Develop a straw proposal for the most accurate way to determine ex-ante savings estimates for advanced lighting controls systems; encourage implementation into IOU program analysis	Develop short list of high-potential technologies and applications	Q1 2014
	Develop a list of necessary DEER inputs for these technologies	Q1 2014
	Outline an approach to quantifying the necessary DEER inputs	Q2 2014
	Present draft results and obtain stakeholder comments	Q3 2014
	Finalize proposal and present to Energy Division staff and other relevant stakeholders	Q4 2014
3-4: Develop pilot programs that support best practices and encourage lighting market transformation	Coordinate with the IOUs' Statewide Lighting Innovation Program team and RD&D advisory group (from Goal 4) to develop a list of technologies to include in pilot programs	Q1 2014
	With the same group, review and discuss possible program implementation strategies for pilot programs	Q1 2014
	Convene periodic meetings to refine and prioritize the technology/implementation strategy lists and obtain updates on pilot program activities	Ongoing
3-5: Prepare a white paper outlining the pros and cons of open-source and proprietary lighting communication protocols to inform discussions regarding the implications for IOU programs	Create an outline of the white paper and agree upon the elements that should be included	Q3 2014
	Review outline and make assignments	Q4 2014
	According to outline, document the pros and cons associated with open-source and proprietary lighting communication protocols	Q1 2014
	Present draft results and obtain stakeholder comments	Q1 2014
	Finalize results and present to Energy Division staff and other relevant stakeholders	Q2 2014

Goal 2

CA Energy Efficiency Strategic Plan

- Strategy 3: Identify best practice lighting technologies and systems and incorporate into utility programs.

Initiative	Key Actions	Timeline	Complete?
3-1: Identify and publicize current list of best practice lighting technologies and systems	Convene a diverse group of stakeholders to review current set of best practice lighting technologies and systems	Q3 2013	In Progress

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LAP UPDATES
Goal 2
Strategy 4

Goal 2

CA Energy Efficiency Strategic Plan

- **Goal 2** – BEST PRACTICES

  Define and advance best practices for design, installation, operation and maintenance of integrated systems to achieve sustainable lighting solutions for all spaces.

Goal 2

- Strategy 4: Educate and train lighting contractors and other professionals to properly design, install and maintain advanced lighting systems.
  - Champions:
    - Mark Ouellette, ICF International
    - Vireak Ly, Southern California Edison

Goal 2

- Strategy 4: Educate and train lighting contractors and other professionals to properly design, install and maintain advanced lighting systems.

Initiative	Key Actions	Timeline
4-1: Identify gaps in current training offerings and barriers to participation and encourage development of training to address these shortcomings.	Create a matrix of current training activities showing their sponsors, target audiences, locations, objectives, and content	COMPLETE
	Examine matrix to identify gaps in availability of training for specific audiences, individuals in specific geographic areas, and specific training topics or content	Q3 2013
	Compile a list of current and past EM&V studies and other relevant materials that shed light on training barriers	Q3 2013
	Review and summarize materials regarding gaps and barriers	Q4 2013
	Share results with relevant stakeholders (such as representatives from ED, California utilities, and training organizations) and discuss possible changes to existing training (or new training) to fill gaps and address barriers	Q4 2013

Goal 2

- Strategy 4: Educate and train lighting contractors and other professionals to properly design, install and maintain advanced lighting systems.

Initiative	Key Actions	Timeline	Complete?
4-1: Identify gaps in current training offerings and barriers to participation and encourage development of training to address these shortcomings	Examine matrix to identify gaps in availability of training for specific audiences, individuals in specific geographic areas, and specific training topics or content	Q3 2013	NO
	Compile a list of current and past EM&V studies and other relevant materials that shed light on training barriers	Q3 2013	NO

Goal 2

- Strategy 4: Educate and train lighting contractors and other professionals to properly design, install and maintain advanced lighting systems.
  - Initiative 4-1: Identify gaps in current training offerings and barriers to participation and encourage development of training to address these shortcomings
  - **Key Action: Examine matrix to identify gaps in availability of training for specific audiences, individuals in specific geographic areas, and specific training topics or content**
  - Status: Not Completed

Goal 2

- Brief Update:
  - New title 24 codes require acceptance testing of lighting controls impacting more than 10% of a building space that is retrofitted
  - Launched CALCTP-AT training for electrical contractors, electricians, professional engineers, and commissioning agents
  - Will also incorporate Lighting Market Transformation (LMT) data into completed matrix of training activities.
  - Next steps: Set up initial meeting to examine the matrix by Q4. Potentially plan for plan for a larger meeting with broader stakeholders in Q1 2014 if needed.

Goal 2

- Strategy 4: Educate and train lighting contractors and other professionals to properly design, install and maintain advanced lighting systems.
  - Initiative 4-1: Identify gaps in current training offerings and barriers to participation and encourage development of training to address these shortcomings
  - **Key Action: Compile a list of current and past EM&V studies and other relevant materials that shed light on training barriers**
  - Status: Not Completed

Goal 2

- Brief Update:
  - Active Utility Trials and Pilots
    - SCE is in the process of implementing a trial program and study to evaluate and learn how best to support improved installations through certified electricians and contractors.
    - PGE has released a pilot incentive to also study contractor training on improving lighting installations
  - Next steps: Work with IOU and CPUC ED Measurement and Evaluation (M&E) teams to collect Evaluation, Measurement, and Verification (EM&V) studies

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LAP UPDATES
Goal 2
Strategy 5

Goal 2

CA Energy Efficiency Strategic Plan

- **Goal 2** – BEST PRACTICES

  Define and advance best practices for design, installation, operation and maintenance of integrated systems to achieve sustainable lighting solutions for all spaces.

Goal 2

CA Energy Efficiency Strategic Plan

- Strategy 5: Explore ways to increase the participation of public entities (including cities and municipalities) in current IOU programs that offer incentives and financing for lighting measures.
  - Champions:
    - Jennifer Lawrence, Cree
    - René Burger, Philips Lighting Company

Goal 2

- Strategy 5: Explore ways to increase the participation of public entities (including cities and municipalities) in current IOU programs that offer incentives and financing for lighting measures.

Initiative	*Key Actions*	*Timeline*
5-1: Conduct information-sharing meetings with relevant representatives of public agencies, ED, utilities, and other stakeholders to ensure awareness of and access to utility programs	Research decision-making responsibilities of individuals responsible for renovation decisions at public agencies and generate a list of those individuals	Q3 2013
	Convene a meeting (or series of meetings) involving these individuals, utility and ED representatives, and other stakeholders to share information about existing programs, barriers to participation in those programs, and possible ways to overcome those barriers	Q4 2013
	Conduct ongoing outreach and follow-up to support (to the extent possible) increased participation of public agencies in utility lighting programs	2014

Goal 2

- Strategy 5: Explore ways to increase the participation of public entities (including cities and municipalities) in current IOU programs that offer incentives and financing for lighting measures.

Initiative	Key Actions	Timeline	Complete?
5-1: Conduct information-sharing meetings with relevant representatives of public agencies, ED, utilities, and other stakeholders to ensure awareness of and access to utility programs	Research decision-making responsibilities of individuals responsible for renovation decisions at public agencies and generate a list of those individuals	Q3 2013	YES

Goal 2

- Strategy 5: Explore ways to increase the participation of public entities (including cities and municipalities) in current IOU programs that offer incentives and financing for lighting measures.
  - Initiative 5-1: Conduct information-sharing meetings with relevant representatives of public agencies, ED, utilities, and other stakeholders to ensure awareness of and access to utility programs
  - **Key Action: Research decision-making responsibilities of individuals responsible for renovation decisions at public agencies and generate a list of those individuals**
  - Status: Completed

Goal 2

- Brief Update:
  - Developing a meeting schedule at either AESP or the local utilities the last week of January.
    - Meet in person with local government partnerships of each IOU/partnership managers
    - Conference call participants that shared experiences working with utilities, schedule follow – up meting/ conference call
      - >Discuss ways of working , improve process
  - Obtain insights on new California Spec and effect on renovation decisions
  - Explore impact of Assembly Bill (AB) 719

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LAP UPDATES
Goal 3
Strategy 6

Goal 3

Goal 3

- **Goal 3 –** END-USER DEMAND

  Create widespread end user demand to purchase and use best practice lighting technologies and systems.

Goal 3

- Strategy 6: Relying on input from a diverse group of stakeholders (including the CPUC, other government agencies, utilities, and industry), determine the most effective messaging for different end-user groups; and develop a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems.
  - Champions:
    - Juan Carlos Blacker, Independent Consultant
    - Caroline Chen, Southern California Edison
    - Alice Liddell, ICF International
    - Christopher Lubeck, OSRAM SYLVANIA
    - Andrea Nylund, Eco Hatchery
    - Andrea Riemann, PG&E
    - Brian Smith, PG&E
    - Glen Whitehead, Cree

Goal 3

- Strategy 6: Relying on input from a diverse group of stakeholders (including the CPUC, other government agencies, utilities, and industry), determine the most effective messaging for different end-user groups; and develop a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems.

Initiative	Key Actions	Timeline
6-1: Institute a statewide study to assess end-user wants, needs, and desirability of currently-installed lighting technologies; publicize results to help tailor product marketing and messaging	Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs	Q3 2013
	Present results in a digestible form to Lighting Action Plan champions, the IOU Lighting Market Transformation Program team, and other stakeholder groups to support development of targeted messaging to address end-user wants and needs	2014
6-2: Create and publicize an inventory of financing options for best practice lighting technologies and systems	Investigate and catalogue financing options (including utility resources and others)	COMPLETE
	Review available literature on customer demand for financing and loan packages for energy-efficient upgrades (lighting-specific, if possible)	Q3 2013
	Prepare a brief white paper summarizing demand for and availability of financing options	Q4 2013
	Work with ED staff and broader stakeholder group to determine possible venues in which to share white paper results with a broader audience	2014
6-3: Create and distribute the most effective messaging through a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems	Determine best message for each user group	Q4 2013
	Determine best partners and outlets for a coordinating marketing approach and engage them into Lighting Action Plan	2014
	With partners, develop marketing and education platform to encourage adoption of best practice lighting technologies and systems.	2014

Goal 3

- Strategy 6: Relying on input from a diverse group of stakeholders (including the CPUC, other government agencies, utilities, and industry), determine the most effective messaging for different end-user groups; and develop a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems.

Initiative	Key Actions	Timeline	Complete?
6-1: Institute a statewide study to assess end-user wants, needs, and desirability of currently-installed lighting technologies; publicize results to help tailor product marketing and messaging	Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs	Q3 2013	N (underway)
6-2: Create and publicize an inventory of financing options for best practice lighting technologies and systems.	Review available literature on customer demand for financing and loan packages for energy-efficient upgrades (lighting-specific, if possible)	Q3 2013	N (underway)

Goal 3

- Strategy 6: Relying on input from a diverse group of stakeholders (including the CPUC, other government agencies, utilities, and industry), determine the most effective messaging for different end-user groups; and develop a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems.
  - Initiative 6-1: Institute a statewide study to assess end-user wants, needs, and desirability of currently-installed lighting technologies; publicize results to help tailor product marketing and messaging
  - Key Action: Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs
  - Status: Not completed, targeted to be done before end of year
  - Brief Update:
    - Studies to be included have been identified, summaries now being created.

Goal 3 - Initiative 6-1 Update

CA Energy Efficiency Strategic Plan

- Key Action: Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs
- Lit Review target audience is California IOU lighting program managers
  - Lighting PMs are often required to assist market actors in positioning, promoting, and pricing lighting
- Existing research: Many Goals, Many Studies

Serves Initiative 6-1

- Statewide study to assess end-user wants and needs of currently installed lighting technologies

Informs Initiative 6-3

- Create most effective messaging through a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems

Goal 3 - Initiative 6-1 Update

CA Energy Efficiency Strategic Plan

- Key Action: Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs
- There are many relevant studies available. Literature review will provide an overarching summary of customer wants and needs findings from all available, relevant literature.
- Review will leverage existing literature reviews, including:
  - California Lighting Critical Synthetic Literature Review
  - Evergreen Economics and D&R International, for PG&E and SCE, 2012
  - Commercial Lighting Retrofits – Targeted Research
  - Evergreen Economics, Research Into Action, D&R International, 2013
- Because of the number of studies, the review will focus on recent work, including some studies soon-to-be-released.

Goal 3 - Initiative 6-1 Update

CA Energy Efficiency Strategic Plan

- Key Action: Review and synthesize results of completed residential and non-residential studies to identify and document end-user wants and needs
- Lit review will include lighting studies conducted on behalf of the following agencies:
  - Bonneville Power Authority (BPA)
  - California Public Utilities Commission (CPUC)
  - U.S. Department of Energy (DOE)
  - National Grid
  - Northwest Energy Efficiency Alliance (NEEA)
  - Northeast Energy Efficiency Partnerships (NEEP)
  - Pacific Gas and Electric Company (PG&E)
  - Southern California Edison (SCE)
- And one meta-study called “Office of the Future”, conducted on behalf of SCE, PG&E, NEEA, NYSERDA, SMUD, BC Hydro, National Grid, and NSTAR.
- As part of its lit review for the financing sector, Cadmus will be identifying additional studies that contain any information on financing lighting measures.

Goal 3

CA Energy Efficiency Strategic Plan

- Strategy 6: Relying on input from a diverse group of stakeholders (including the CPUC, other government agencies, utilities, and industry), determine the most effective messaging for different end-user groups; and develop a coordinated marketing approach to educate end users and encourage adoption of best practice lighting technologies and systems.
  - Initiative 6-2: Create and publicize an inventory of financing options for best practice lighting technologies and systems
  - Key Action: Review available literature on customer demand for financing and loan packages for energy-efficient upgrades (lighting-specific, if possible)
  - Status: Not Completed
  - Brief Update:
    - September 2013 – CPUC approved a package of innovative financing programs targeting single-family, multi-family and non-residential customers
      - Included capabilities such as On-Bill Repayment and Credit Enhancement,
      - Currently, for non-residential loans, there is a cap of 20% for lighting retrofits. Necessary to encourage the customers to move beyond lighting measures to support more comprehensive energy actions.
    - We expect these loan/finance program services to be available during the first half of 2014.
    - IOUs are currently working with the Cadmus Group to do investigate all possible loan and financing options in California.
    - This research work may take the form of interviewing financial institutions or additional literature research.
    - Projected task completion of Q2 2014

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LAP UPDATES
Goal 4
Strategy 7

Goal 4

CA Energy Efficiency Strategic Plan

- **Goal 4 –** Research, Development, & Demonstration

  Develop research, development and demonstration (RD&D) networks to create, test and deliver the lighting solutions needed to transform California's lighting market and achieve ZNE goals.

Goal 4

CA Energy Efficiency Strategic Plan

- Strategy 7: Develop a unified vision to guide statewide lighting RD&D efforts
  - Champions:
    - Chris Corcoran, Pacific Gas & Electric
    - Dustin Davis, California Energy Commission
    - Brian Fortenbery, Electric Power Research Institute
    - Jennifer Burns, Philips Lighting Company
    - Jennifer Lawrence, Cree
    - Joseph Dario Moreno, Southern California Edison
    - Konstantinos Papamichael, California Lighting Technology Center
    - Michael Nguyen, SDG&E
    - Michael Mutmansky, TRC
    - Abhijeet Pande, TRC
    - Frank Sharp, Electric Power Research Institute

Goal 4

CA Energy Efficiency Strategic Plan

- Strategy 7: Develop a unified vision to guide statewide lighting RD&D efforts

Initiative	Key Actions	Timeline
7-1: Develop an RD&D roadmap and support structure	Convene a diverse group of stakeholders (including representatives from the CPUC, other government agencies, utilities, and industry) to form an RD&D advisory body and identify necessary elements of the roadmap	COMPLETE
	Identify PIER and EPIC lighting projects and align their research goals with the goals of the Lighting Action Plan	COMPLETE
	Establish and agree upon metrics to measure within the roadmap and establish a timeline for roadmap implementation based on PIER projects	Q4 2013
	Review, finalize, publish, and promote the roadmap	Q1 2014
	Continue collaboration with CEC and other agencies to ensure that RD&D funding opportunities (e.g., EPIC) align with the goals of the Lighting Action Plan	Ongoing
	Hold periodic stakeholder meetings to share RD&D roadmap progress and results	Ongoing
7-2: Develop demonstration projects for advanced lighting systems in a range of space types	Identify the proper “range of space types” and contextual characteristics for the demonstrations	Q4 2013
	Coordinate with PIER/EPIC, utility emerging technologies programs, and other stakeholders to develop guidelines for demonstration projects	Q2 2014
	Identify funding sources for demonstration programs	Q2 2014
	Develop demonstration project proposals	Q3 2014
	Implement and evaluate demonstration projects; share results with stakeholders	2015

Goal 4

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- Strategy 7: Develop a unified vision to guide statewide lighting RD&D efforts
  - No key actions due during Q3 2013
  - Updates available on a few activities due soon

Goal 4 – Initiative 7-1 Update

- Initiative 7-1: Develop an R&D roadmap and support structure
  - Develop R&D objectives
    - Identify key questions that need to be answered to advance lighting efficiency in the market
  - Identify current R&D projects and timelines
  - Build matrix of objectives and projects
  - Identify objectives not addressed by current projects and propose Electric Procurement Investment Charge (EPIC) RFP to address them
  - Build R&D roadmap based on current and proposed projects and timelines

Goal 4 – Initiative 7-2 Update

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- Initiative 7-2: Develop demonstration projects for advanced lighting systems in a range of space types
  - Formulate data schema for demonstration information
    - Sponsor
    - Technology
    - Application
  - Identify past and current demonstration projects
  - Build matrix of technologies and applications for demonstrations
  - Identify demonstrations needed
    - Specific lighting technologies
    - Identify range of applications (space type, location, etc.)

Goal 4 – R&D Objectives

- R&D Objectives
  - Reliable, cost-effective sensing for automated controls
    - Occupancy sensing for occupancy/vacancy-based lighting control
      - Long range
      - Short range
    - Photo sensing for electric lighting controls for daylight harvesting
      - Side-lit spaces
  - Lighting quality
    - Better color rendering metrics
    - Better flicker metrics
    - Dimmability
    - Consideration of spectral power distribution (SPD), especially for blue light

Goal 4 – Project Roadmap

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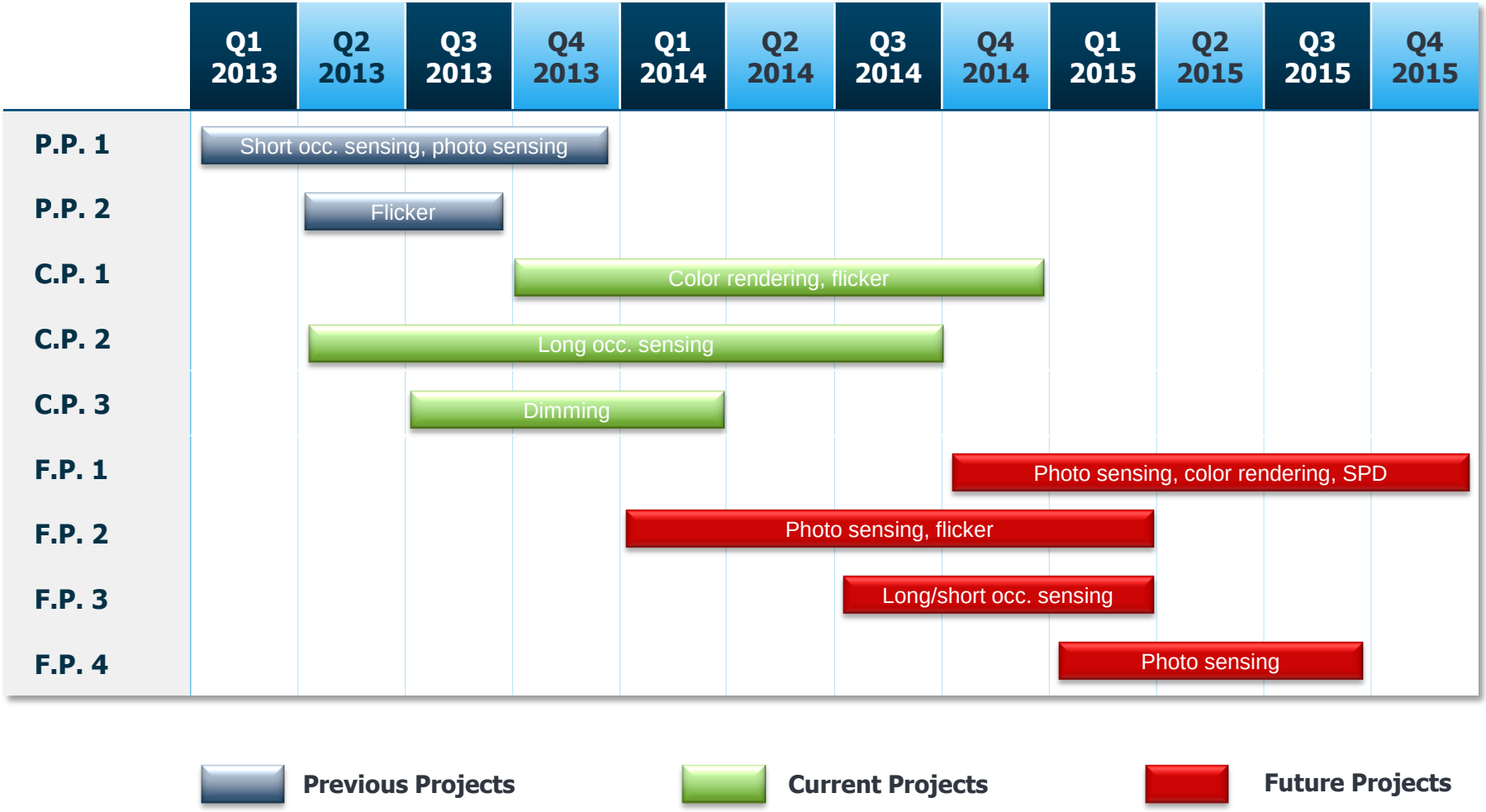

Goal 4 – Project Matrix

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	P.P. 1	P.P. 2	C.P. 1	C.P. 2	C.P. 3	F.P. 1	F.P. 2	F.P. 3	F.P. 4
Long range occ. sensing				X				X	
Short range occ. sensing	X							X	
Photo sensing	X					X	X		X
Color rendering			X			X			
Flicker		X	X				X		
Dimming					X				
SPD consideration						X			

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OVERVIEW OF AFTERNOON SESSION

Overview

- Return to this room after lunch (by 1:00pm)
- Presentation on 2010 Lighting Technology Overview (30 min)
- Break-Out Group Discussions (1 hour)
  - Three sectors: Commercial, Residential, Exterior (Outdoor)
  - Objective: Generate a list of additional best practice technologies/systems that should be included in 2014 update to Lighting Technology Overview for your sector
  - Return to this room when your break-out discussion is complete OR by 2:30pm (whichever comes first)
  - We will review break-out group assignments after the Lighting Technology Overview Presentation

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LUNCH BREAK

PLEASE RETURN HERE BY 1:00PM

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LIGHTING TECHNOLOGY OVERVIEW

2010 Lighting Technology Overview

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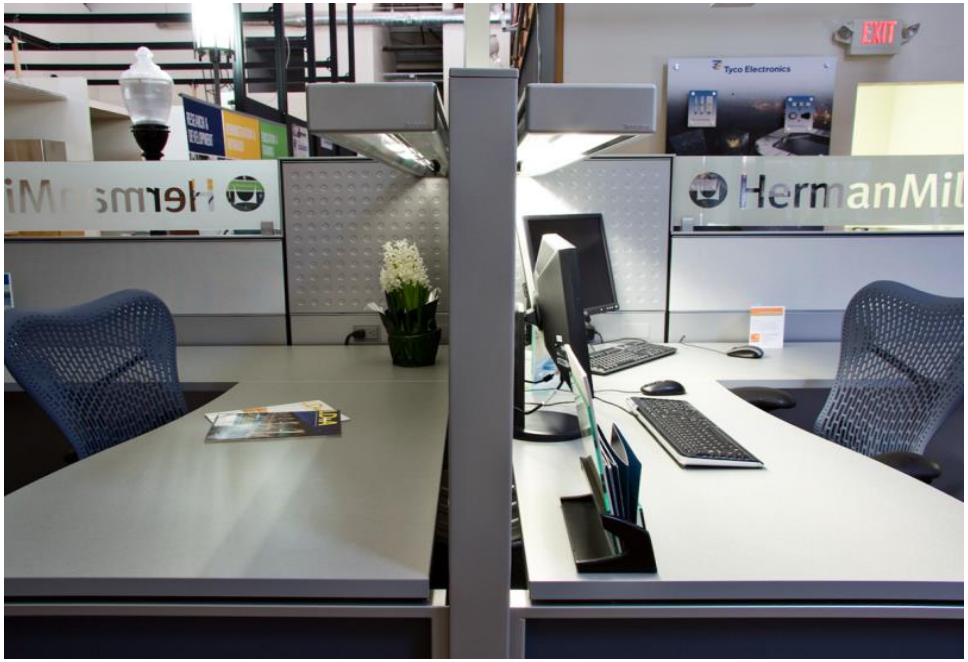
- **Commercial Lighting**
  - Task-Ambient Lighting
  - Integrated Classroom Lighting Systems
  - Multi-Level Switching with Occupancy Sensors
  - ~~HID Electronic/Dimmable Ballasts~~
  - LED Downlights
  - ~~Dimmable/Controllable Fluorescent Ballasts~~
  - Daylight Strategies and Technologies
- **Residential Lighting**
  - ~~Dimmable CFLs~~
  - ~~Halogen IR~~
  - LED Fixtures and Systems
  - Occupancy Controls
  - Super Lamp
- **Exterior Lighting**
  - Smart Exterior Lighting for Commercial Applications
  - Next-Generation Street Lighting

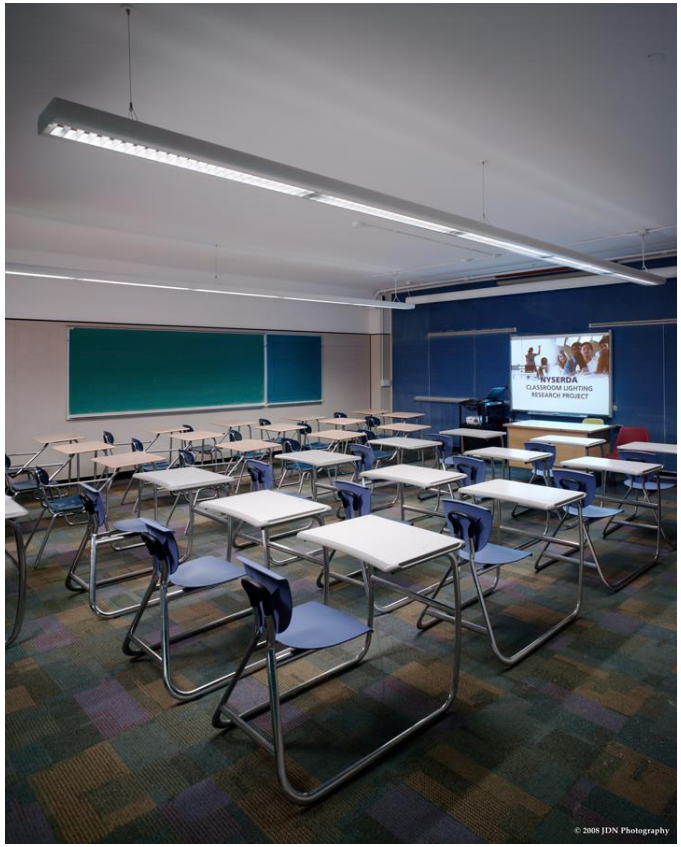
Commercial Lighting: Task-Ambient Lighting

- 40-50% energy savings
- Commercial office spaces
- Integrated task-ambient lighting systems



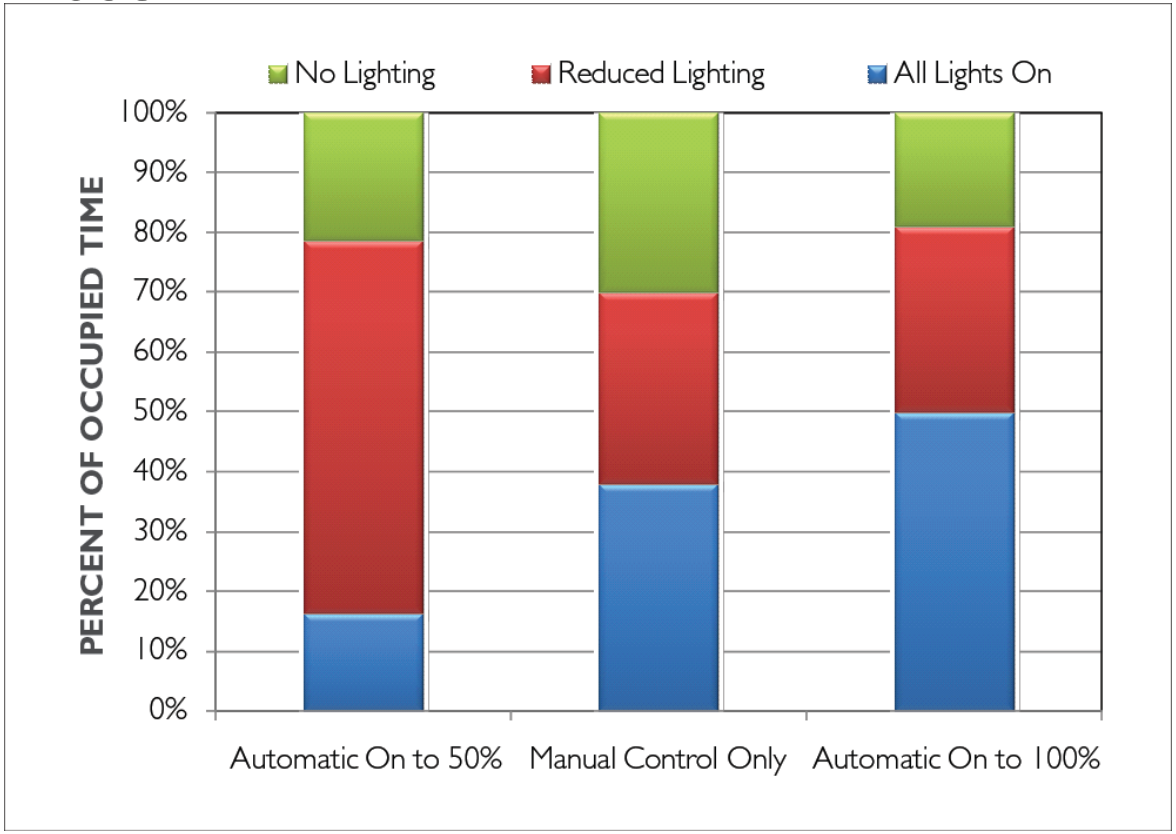
Commercial Lighting: Integrated Classroom Lighting Systems

- 30-50% energy savings
- Single-source solution with electric lighting, daylighting, and controls



Commercial Lighting: Multi-Level Switching with Occupancy Sensors

- 24-52% energy savings
- Private offices



Commercial Lighting: LED Downlights

- 40-75% energy savings
- Popular fixture type in many applications

Commercial Lighting: Daylight Strategies and Technologies

- 40-80% energy savings
- Windows and skylights
- Daylight harvesting

Residential Lighting: LED Fixtures and Systems

- 40-80% energy savings
- Incorporate LED fixtures into new homes
- Retrofit existing fixtures to LEDs

Residential Lighting: Occupancy Controls

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- 11% energy savings with 50% occupancy
- Bathrooms and laundry rooms
- Underused in residential

Residential Lighting: Super Lamp (lamp replacement initiative)

- 16.8W potential power reduction
- Screw-base sockets
- Make high-efficacy lamps mainstream choice
- Converted to CA Lighting Quality Specification

Exterior Lighting: Smart Exterior Lighting for Commercial Applications

- 30-50% energy savings
- Occupancy controls
- Luminaire replacement

Exterior Lighting: Next-Generation Street Lighting

- 20-40% energy savings
- Replace HPS lamps
- Improve CCT and CRI

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BREAK-OUT GROUP DISCUSSIONS: BEST PRACTICES BY SECTOR

Overview

- Break-Out Group Discussions (1 hour)
  - Three sectors: Commercial, Residential, Exterior (Outdoor)
  - Objective: Generate a list of additional best practice technologies/systems that should be included in 2014 update to Lighting Technology Overview for your sector
  - Return to this room when your break-out discussion is complete OR by 2:30pm (whichever comes first)
  - We will review break-out group assignments after the Lighting Technology Overview Presentation

Breakout Room Assignments

- Assignment is based on the letter on your nametag (C, R, or O)
- Three groups:
  1. Commercial Lighting Group
     - Code: C
     - Facilitator: Jeorge Tagnipes, CPUC Energy Division
     - Room Name: Mission Room
  2. Residential Lighting Group
     - Code: R
     - Facilitator: Jenna Canseco, DNV KEMA Energy & Sustainability
     - Room Name: Courtyard
  3. Exterior (Outdoor) Lighting Group
     - Code: O
     - Facilitator: Katherine Burggraf, California Lighting Technology Center
     - Room Name: Cabrillo Room

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REPORTING FROM BREAK-OUT GROUP DISCUSSIONS

Commercial - Task Ambient

- Task Ambient Lighting
  - Office: people could just override
  - Limitation:
    - Need to also work with the furniture
    - Need a full redesign
    - Limited to fluorescent source
  - Fed exempt
  - Utility incentives for advanced
  - Saves a lot of labor

Commercial - Task Ambient

- SMUD did some case studies
- Office of the future
- **Focus on New Construction**
  - **Office Furniture making trade association (Tambient – big player)**
- Task lighting or control
  - Complete from scratch
  - Retrofitted control system
- **Personal dimming (calculated incentive)**

Commercial - Task Ambient

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- Individual task light
  - If ceiling reduced with dimming
  - Just adding to load
  - Could be done, need to quantify the savings

Commercial - LED office lighting

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- LED 2X4 (troffers)
- Some problems
  - Cost difference
  - Controllability
  - glare
- Some good things
  - Driver could have controls
  - Works with new code
  - Should have guidelines

Commercial - LED office lighting

- Direct replacement
- Look at fixture as its own system
- DLC listed (could address some quality concerns)
  - But could rule out some products
- Safety concerns

Commercial - Network controls

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- Addressability
- Reporting
- Benchmark for claimed savings
- EM&V

Barrier

- Cost (payback 50 years)

Only way to get savings from beyond daylight harvesting

Commercial - Classroom systems

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- -via prop 39 (next year)
  - **What are the best practices for classrooms so Prop 39 gets it right**
    - **Lighting innovation**
    - **Finelite**
- Override is an issue
- LED tube (has issues with T24 code)

Commercial – High-bay LED

- Opportunity for network controls and zone outs
  - Climb up just to adjust occ sensor
- Replacement Fluorescent or HID
- Ambient temperature of the space is a good barrier (160 degree temps up there)
- Only 5 retrofit kits for high bays
- CEE lighting template for warehouses
- Target
  - Refrigerated warehouse spaces

Commercial - Retail

- Limited decorative products
  - Casinos Airports Hotels
- Controls cause new replacement fixtures
- Range of product size, shape, etc.
- Cove lighting
- Specialty, high end
- Low volume

Commercial - Retail

- Window displays to be circuited separately
- LED with reduced output
- Lights on all the time
- Auto dealership
- High CRI

Residential – Controllable/Smart Lighting System

- Components include:
  - Wireless home energy network – "intelligent platform"
    - Fully controllable, dimmable, addressable lamps
  - "Intelligent Bulb"
    - Variable color / Color-tuning lamps (e.g., Philips HUE, Sylania E-lamp intelligent bulb)
  - Other controls
    - Timers
    - Sensors
- Barriers
  - Cost
  - Accessibility (in terms of income level – related to cost)
  - Quality → lack of standards
  - Awareness
  - Education ← regarding how to harness this for energy savings; whole new perspective on lighting your home
  - ~~Availability?~~

Residential – Daylighting

- Light tubes
- Daylighting controls

- Barriers
  - These are a difficult sell because the CA IOUs cannot provide incentives for daylighting in residential applications
    - But maybe there's a way to incorporate these measures into a whole house program…?

Residential – Dimmable Lamps

- There needs to be a technology-neutral standard for dimmable lamps that addresses things like…
  - Dimmable curve should mimic incandescent
  - No buzzing/humming
  - No flickering
  - Dim down to 10 percent -ish

- Energy Star v1
  - Dimming testing – dim without flicker down to 20%
  - CEC requires dimming down to 10% without flicker

Residential – Other Technologies

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- OLEDs are not quite mainstream enough yet to be a large-scale best practice…
  - But they may be the best practices for certain niche applications

Residential – Other Considerations

- When the LTO discusses LED lamps, it should highlight a move toward higher-efficacy lamps
  - Not just improved CRI, but improved efficacy
    - However… higher efficacy = higher cost – this is also a concern
    - May be an educational element here – need to convey to end-users that they're paying for
    - Ultimately, what we want is the best color quality at the highest efficacy and the lowest cost
- Interface between behavior and lighting technologies is still a little hazy – particularly for controls
  - Requires further study

Residential – Lingering Questions

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- Should we consider efforts aimed at transitioning customers away from inefficient fixtures and lamps to make room for new purpose-driven technologies?
  - Designed to maximize efficiency of the technology
- How do we get end-users accustomed to lamps and fixtures that have a new look and feel?
  - "If it doesn't look like my old incandescent, I don't like it"
  - INERTIA
- Should we consider early compliance incentives for upcoming code changes….?

Outdoor Lighting

- Street lighting
  - Adaptive controls
    - Time-of-day scheduling
    - Occupancy sensing
    - Base on volume data rather than real-time sensors
  - Consider pedestrian conflict values at different times of night to adjust light levels
  - Change out HPS for white light sources
  - LED light sources
  - Over spec and operate at lower level
  - Centralized network location
  - Re-evaluate current lighting practices
  - Reduce uplight
  - Specify twist-lock fixture and dimmable circuits for forward compatibility

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WRAP UP & NEXT STEPS

Wrap-Up and Next Steps

- Next steps
  - Updating Lighting Action Plan document (living document)
    - Nov 2013 update posted on the CPUC's Strategic Planning site: www.cpuc.ca.gov/lap
  - Quarterly webinar
  - Advance initiatives
  - Influence program design

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THANK YOU for your participation!

California Public Utilities Commission
Energy Division

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STRATEGY GROUP MEETINGS